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REVISION OF THE COYOTES OR PRAIRIE WOLVES, WITH DESCRIPTIONS OF NEW FORMS.

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It has been customary to regard the Coyote as a single species, inhabiting western North America from the plains of the Saskatchewan to the southern end of the tableland of Mexico, and from the fertile prairies of the Mississippi Valley to the Pacific coast. A somewhat hasty study of the material now in hand, however, shows that the name Coyote has not been applied to a single animal, but to an assemblage of species comprising three well marked subordinate groups and a considerable number of distinct geographic forms. The results of this and similar studies should serve as a word of caution to those who are in the habit of citing the wolves, cats, weasels, and other groups as 'species' whose ranges violate the laws of geographic distribution.

It is often assumed that wolves and other large animals have no fixed home, but roam at will over enormous areas, the mothers stopping to give birth to and care for their young wherever chance finds them at the time. Except in the case of certain gregarious Ungulates, as the Buffalo, this belief is opposed to the laws of geographic distribution and the known facts respecting the breeding habits and 'home instincts' of animals. It is of course true that wolves which hunt in packs and follow moving herds travel relatively great distances, and that in winter they perform regular migrations and also roam irregularly over large tracts of country in search of food; but even these movements have geographic limitations, as proved by the constancy with which particular geographic forms are found within par-

ticular areas. Thus the snow-white Arctic Wolf never reaches the northern border of the United States, no matter how severe the winter, and the Red Wolf of Texas is unknown on our northern plains. In the case of the Coyote the present study goes far to show that except in winter, when migratory movements take place, the distances traveled by individual wolves are not sufficient to prevent the various species and subspecies from conforming to the faunal zones. It must be expected, however, that the belts of overlapping between the several zones will be broader in the case of such wide ranging animals as wolves than in the case of those whose means of locomotion are more limited.

The three groups of Coyotes have distinctive geographic ranges which conform to the well known life zones. Beginning at the north, they may be known as (1) the *latrans* group, inhabiting the Upper Sonoran and Transition zones and the southern edge of the Boreal; (2) the *frustror* group, inhabiting the Lower Sonoran of Texas (and probably Oklahoma and Indian Territory), the tableland of Mexico (at least its southern part), and the peninsula of Lower California, and (3) the *microdon* group, inhabiting the Arid Tropical belts of both coasts of Mexico and the lower Rio Grande region of Texas, and also the Lower Sonoran deserts of Arizona, Nevada, Utah, and California. *Canis latrans* is the largest of the Coyotes and has the largest teeth; *C. frustror* and its allies are of medium or rather large size and have somewhat smaller teeth; *C. microdon* and its relatives are smaller and have very much smaller teeth.

The eleven forms here recognized, with their type localities, are as follows:

1. Latrans group.
   Canis latrans Say. Council Bluffs, Iowa.
   pallidus nob. Johnstown, Nebraska.
   lestes nob. Toyabe Range, Nevada.

2. Frustror group.
   Canis cagottis H. Smith. Rio Frio, near city of Mexico.
   frustror Woodhouse. Fort Gibson, Indian Territory.
   peninsulæ nob. Cape St. Lucas, Lower California.

3. Microdon group.
   Canis microdon nob. Mier, Tamaulipas, Mexico.
   mearnsi nob. Quitobaquita, Pima County, Arizona.
   estor nob. San Juan River, Utah.
   ochropus Esch. 'California' (San Joaquin Valley).
   vigilis nob. Manzanillo, Colima, Mexico.

Geographic Distribution and Interrelations.

The material available for the present study is insufficient to admit of mapping the boundaries of the areas inhabited by the several forms, of describing the seasonal differences in pelage, or of determining which members of each group do and which do not intergrade; hence all are here treated as species. This much, however, may be said with considerable confidence: *Canis latrans* inhabits the humid prairies and bordering woodlands of the northern Mississippi Valley in Iowa and Minnesota, and follows the northern edge of the plains westward to the base of the Rocky Mountains in the province of Alberta. On the adjacent arid plains from eastern Colorado to Montana and Assiniboia it is replaced by and probably intergrades with the very pale *C. pallidus*. In cranial characters *C. pallidus* is closely related to the form inhabiting the plains of the Columbia in eastern Oregon and Washington, which appears to grade insensibly into *C. lestes*, the Coyote of the Transition zone from the dry interior of southern British Columbia, Washington, and Oregon southward over the higher lands of the Great Basin, the Sierra Nevada, and the Rocky Mountains to the plateau of northern Arizona, and thence along the continental divide to the Mexican boundary. It is not improbable, therefore, that the three members of the *latrans* group intergrade, though no skins showing intergradation have been seen.

The three members of the *frustror* group, on the other hand, are probably specifically as well as geographically distinct. Still, the limits of their ranges are unknown. *Canis frustror* inhabits the Gulf region of Texas from Nueces Bay northward and will probably be found throughout the Lower Sonoran area of Texas, Oklahoma, and Indian Territory. Its distant relative, *C. cagottis*, is known from only the southern part of the tableland of Mexico, but probably ranges northward along the west side of the tableland. The third member of the series, *C. peninsulæ*, is supposed to be restricted to the peninsula of Lower California.

The *microdon* group contains five very different forms. Of these, *C. microdon* inhabits the arid tropical or 'Tamaulipan' fauna of northeastern Mexico and the Lower Rio Grande region in Texas; *C. vigilis* the arid tropical coast region of Colima in western Mexico; *C. mearnsi* the Lower Sonoran areas of northern Sonora and southern Arizona; *C. estor* the adjacent Lower

Sonoran deserts of eastern California, Nevada, and Utah, and *C. ochropus* the Lower Sonoran San Joaquin Valley of California. Apparently the only forms in this series which can possibly intergrade are *C. mearnsi* and the pallid *C. estor.*

It should be observed that two of the groups—the *latrans* and the *microdon*—have each a pallid representative, and that these representatives (*pallidus* and *estor*) resemble one another externally so closely that they are hardly distinguishable except by size, while a glance at their teeth shows that they belong to opposite extremes of the whole series. It is not impossible that the third (or *frustror*) group also has a pallid member, but no specimens from the southern plains have come to hand.

Good skins with skulls are much needed from all parts of Mexico, Texas, Indian Territory, Oklahoma, New Mexico, southern Colorado, western Arizona, the Painted Desert in eastern Arizona, the coast ranges of southern California, eastern North Dakota, Manitoba, and the northwest coast region. The pelage is in best condition in early winter immediately after the fall molt, usually in December and January.

History and Nomenclature.

Fortunately the Coyotes have escaped the complicated history and involved synonymy with which most groups are encumbered. This is due in the main to the widespread belief that all of the small wolves of North America belong to a single species.

So far as I have been able to ascertain, only four names have been proposed for the Coyotes. These are *Canis latrans* Say, 1823, for the Upper Mississippi Valley animal; *Canis ochropus* Eschscholtz, 1829, for the species from the interior of California; *Canis frustror* Woodhouse, 1851, for the Indian Territory (and Texas) animal; and *Lyciscus cagottis* Hamilton Smith, 1839, for the one from the southern end of the tableland of Mexico. All of these names are here recognized as designating valid forms.

General Characters.

The pattern of coloration is the same in all the Coyotes. Except in the pale desert forms (*pallidus* and *estor*), in which the fulvous tints are replaced by buff, the muzzle, backs of the ears, outer side (sometimes the whole) of the fore and hind feet and

legs, and distal half of the under side of the tail are some shade of fulvous. The ground color of the back also varies from buff, or even buffy-white in the desert forms, to dull fulvous in the animal from southern Mexico, and the abundance of black-tipped hairs is usually proportionate to the intensity of the ground color. The upper side of the tail is like the back, and about one-third the distance from root to tip it is marked by an elongated black spot. The tip is always black, although it sometimes contains a tuft of white hairs, most often present in *C. ochropus*. The males are decidedly larger than the females.

Compared with the large Wolves, the Coyotes are slender, lithe, and graceful.* They are swift of foot, and in ordinary seasons feed chiefly on rabbits, both jackrabbits and cottontails, but they also catch ground squirrels and other small mammals, snakes, lizards, birds, and insects, and when put to it by hunger do not hesitate to eat carrion. They are also fond of fruit.

Unless the contrary is stated, all of the measurements in the present paper were taken 'in the flesh' by the collector. All are in millimeters.

Descriptions of Species.

Canis latrans Say.

Canis latrans Say, Long's Expedition to Rocky Mountains, I, 168, 1823.

Type locality.—Council Bluffs, Iowa.

Characters.—Size largest of the Coyotes; coloration rather pale; premolar and carnassial teeth very large and greatly swollen.

Color.—Muzzle dull and rather pale fulvous, finely sprinkled with gray hairs (chiefly above) and with black hairs (chiefly on cheeks); top of head from front of eyes to ears grizzled gray, the pale fulvous zone of under fur showing through, but the gray predominating; ears deep rich fulvous, sparingly sprinkled with black hairs; upper parts from ears to tail coarsely mixed buffy gray and black; under parts and upper lip whitish; long hairs of throat sparingly tipped with blackish, giving the broad collar a grizzled appearance; fore legs and feet dirty whitish, becoming dull clay color on outer side of leg; hind legs and feet dull fulvous on outer side, white on inner side and on dorsal surface of feet, the change from fulvous to white rather abrupt; tail narrowly tipped with black; its under side whitish basally, becoming pale fulvous on distal half and tipped and edged with black.

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* It is hoped that no one will be misled, either as to the form or coloring of the Coyotes, by the gross caricature bearing their name in Mivart's recent 'Monograph of the Canidæ.'

Cranial and dental characters.—Eastern [illegible] skull* and teeth, particularly the la[illegible] largest of the group, the latter than in the other forms; premolars very much swollen, especially the lower ones; carnassial teeth very thick and tumid. Of the forms Coyotes whose skulls approach *C. latrans* in size are *pallidus*, *lestes*, *frustror*, and *ochropus*. The two latter may be dismissed at once on account of the great disparity in the teeth, the carnassials and premolars being hardly more than two-thirds as large as those of *latrans*. *C. frustror* differs further in having the frontals more elevated than in any other member of the group, while in *C. latrans* they are the flattest and most depressed. Large male skulls of *C. ochropus* sometimes have the rostrum (measured from back of last molar to front of incisors) of the same length as small males of *latrans*, but the rostrum is always very much narrower and the postpalatal part of the skull smaller. The difference between *latrans* and *ochropus* in size of teeth is very great, the upper carnassial and first molar together measuring 35 millimeters in an adult male *latrans*, contrasted with 30 in an adult male *ochropus* having the entire tooth row of exactly the same length. In *C. latrans* the premolars are so large that the tooth row is crowded, while in *ochropus* they are widely spaced. The teeth of the female *latrans* are decidedly larger than those of the male *ochropus*.

The species having teeth sufficiently large to require comparison with *latrans* are *pallidus* and *lestes*. In both of these the lateral teeth of the male equal or exceed those of the female *latrans*. Comparing skulls of the same sex, the upper carnassial and first molar and the premolars in both jaws, particularly the lower, are larger, more swollen, and more crowded in *latrans*. In *latrans* also the inner cusp (*protocone*) of the upper carnassial averages decidedly larger than in either of the others.

Measurements.—Female young adult from Elk River, Minnesota: total length, 1219; tail vertebræ, 394; hind foot (in dry skin), 179.

Cranial measurements.—♂ adult from Elk River, Minnesota: basal length, 190; basilar length of Hensel, 186; zygomatic breadth, 109; palatal length, 96; mastoid breadth, 65; length of crown of upper carnassial tooth, 22. The skull of an adult female from Elk River measures: basal length, 175; basilar length of Hensel, 172; zygomatic breadth, 100; palatal length, 96; mastoid breadth, 62; length of crown of upper carnassial tooth, 20.5.

Canis pallidus sp. nov.

Type locality.—Johnstown, Brown County, Nebraska. Type No. 77093, ♂ young adult, U. S. National Museum, Department of Agriculture collection. Collected March 12, 1896, by E. E. Fast.

Characters.—Similar to *C. latrans*, but everywhere paler; backs of ears buff instead of fulvous; skull and teeth smaller.

Color.—Muzzle dull ochraceous buff; top of head grizzled grayish faintly tinged with buff; ears buff; upper parts pale buffy whitish or soiled white

*The skulls of *C. latrans* used in the present comparison are from Elk River, Minnesota.

[illegible]ringly mixed with black hairs, especiall[illegible] f the ta[illegible]dle of back; under parts white; no distinct collar (long hairs [illegible]ck also noticeably tipped with black); fore and hind legs and feet so[illegible] to d[illegible] with faint buffy suffusion on outer side of fore legs, and tinged wi[illegible]st fulvous on outer side of hind legs; tail pale, under side white basal[illegible] coming buff, and narrowly tipped with black.

Cranial and dental characters.—Skull and teeth similar to those of *C. latrans*, but slightly smaller. The lower premolars and carnassial and the upper carnassial and first molar are decidedly smaller and less swollen than in *latrans*.

Remarks.—*C. pallidus* is a pale arid-land representative of *latrans*. It inhabits the Great Plains from eastern Colorado northward into Canada, and is common throughout Montana except in the mountains. On the southern plains, from eastern Colorado southward, it is replaced by another species. Specimens of both have been obtained at Arkins, Colorado.

Measurements.—Unfortunately we have no flesh measurements of the type specimen, but the hind foot (dry) measures 77 millimeters. The form averages a little smaller than *C. latrans*.

Cranial measurements.—(♂ adult, Johnstown, Nebraska.) Basal length, 177; basilar length of Hensel, 173; zygomatic breadth, 100; palatal length, 93; mastoid breadth, 63.5; length of crown of upper carnassial tooth, 21.

Canis lestes sp. nov.

Type locality.—Toyabe Mountains near Cloverdale, Nevada. No. $\frac{24552}{32347}$, ♂ adult, U. S. National Museum, Department of Agriculture collection. Collected November 21, 1890, by Vernon Bailey. Original No. 2223.

Geographic distribution.—Transition and Upper Sonoran areas from the Rocky Mountains westward, and from the arid interior of British Columbia (Aschroft, Shuswap) southward over Washington and Oregon, and the mountains farther south to the plateau region of northern Arizona and New Mexico, and thence southward along the continental divide to the Mexican boundary. In California *C. lestes* inhabits the coast ranges about San Luis Obispo and probably elsewhere, as well as the Sierra Nevada, and in winter it wanders out over the deserts, invading the range of *C. estor*.

Characters.—Size large (next to *latrans*); ears and tail large; coloration almost as in *latrans;* cranial characters as in *pallidus*, but skull and teeth averaging somewhat larger.

Color.—Muzzle very pale cinnamon rufous; top of head from a little in front of eyes to ears grizzled gray and ochraceous; crown, nape, and ears fulvous, deepest on ears; rest of upper parts grayish buffy mixed with black hairs (general effect slightly paler than in *latrans*); underparts whitish, more or less suffused with buffy across middle of belly; long hairs of throat conspicuously tipped with black, forming a broad 'ruff'; fore and hind legs and feet buffy-ochraceous on outer side, whitish on inner side and on upper surface of hind feet; tail broadly tipped with

black; its lower surface whitish on basal third; ochraceous on distal two-thirds, the hairs of terminal third moderately tipped with black, the black increasing toward black end of tail.

Cranial and dental characters.—Skull and teeth clearly of the *pallidus* type; premolar and carnassial teeth smaller and less swollen than in *latrans*. Compared with *C. ochropus*, the skull and teeth are larger and more massive and the rostrum is much broader. A much closer resemblance exists between *C. lestes* and the broad-muzzled *peninsulæ* and *frustror*. Contrasted with *peninsulæ*, the skull is somewhat larger and the teeth heavier; contrasted with *frustror*, the skull is smaller (decidedly shorter), more massive, the frontals flatter and less elevated posteriorly, and the teeth very much larger.

Remarks.—Externally *Canis lestes* resembles *C. latrans*, being much more highly colored than its nearest relative, *C. pallidus*. On the other hand, it is decidedly paler than either *peninsulæ* or *frustror*. Its ears are larger than those of *pallidus* and *frustror*, but smaller than those of *peninsulæ*.

Measurements.—Type specimen, ♂ adult: total length, 1116; tail vertebræ, 320; hind foot, 200.

Cranial measurements.—Type specimen, ♂ adult, rather old: basal length, 170; basilar length of Hensel, 166; zygomatic breadth, 102;* palatal length, 88; mastoid breadth, 62; length of crown of upper carnassial tooth, 21.5.

Canis frustror Woodhouse.

Canis frustror Woodhouse, Proc. Acad. Nat. Sci. Phila., V, 147, 1851.

Type locality.—Fort Gibson, at junction of Neosho River with the Arkansas, Indian Territory.

Characters.†—Similar to *C. peninsulæ*, but somewhat larger; colors paler, ears shorter, rostrum longer.

Color.—Muzzle cinnamon rufous; space between eyes and reaching half way to ears grizzled gray and fulvous; top of head, nape, and ears pale fulvous, deepest on the ears; rest of upper parts buffy-ochraceous, profusely mixed with black; under parts whitish, with a strong buffy-ochraceous suffusion across middle of belly; long hairs of throat conspicuously tipped with black, the black hairs running back over breast along median line; fore and hind legs and feet fulvous all round, deepest on outer side; upper surface of forearm and feet abundantly mixed with black, which forms an almost continuous stripe; antero-external face of thigh well

*The skull of the type is unusually broad across the zygomata. The normal zygomatic breadth in adult male skulls is about 97.

† The present description is from a specimen from Padre Island, Texas, which is unquestionably paler and less red than the animal of the interior. Audubon describes one from San Antonio, Texas, as having the neck reddish brown, "with bars under the throat and on the chest and belly of a reddish tinge." The type specimen of *C. frustror* is in the National Musuem and, as pointed out by Baird, is hardly half grown.

sprinkled with black hairs which reach down more than half way to heel; under side of tail fulvous, white basally, and with hairs of distal half conspicuously tipped with black.

Cranial and dental characters.—Skulls from Padre Island and Nueces Bay are similar to those of *C. peninsulæ* from Lower California, except that they are somewhat larger, have decidedly longer rostrums and more elevated frontals. The elevation of the frontal shield posteriorly is greater than in any other Coyote. The teeth, though relatively smaller, are almost as large as in *peninsulæ*. In the Nueces Bay skulls the upper carnassial is peculiarly swollen and rounded anteriorly, with the inner cusp set back considerably behind the anterior plane of the tooth.

Remarks.—*Canis frustror* (assuming the name to apply to the Padre Island specimen above described) resembles *C. peninsulæ* from Lower California in general characters, differing chiefly in somewhat larger size, paler coloration, shorter ears, larger amount of black on forearm, and longer rostrum.

Measurements.—♂ young adult, Padre Island, Texas: total length, 1190; tail vertebræ, 320; hind foot, 200.

Cranial measurements.—♂ adult from Padre Island, Texas: basal length, 182; basilar length of Hensel, 179; zygomatic breadth, 102; palatal length, 94; mastoid breadth, 63; length of crown of upper carnassial tooth, 19.

Canis cagottis (Hamilton Smith).

Lyciscus cagottis Hamilton Smith, Jardine's Nat. Library, Mammals, vol. IV, 164, 1839.
? Canis nigrirostris Licht., Abhandl. K. Akad. Wiss., Berlin (1827), pp. 105–106, 1830.

Type locality.—Rio Frio, between City of Mexico and Puebla, Mexico.

*Characters.**—Similar to *C. peninsulæ*, but slightly larger and redder, with somewhat shorter ears, larger teeth, and broader rostrum.

Color.—Muzzle bright ferruginous; top of head grizzled buffy-grayish and fulvous, the fulvous predominating, especially posteriorly; crown, nape, and ears fulvous, deepest on the ears; rest of upper parts grizzled fulvous, buffy, and black (the black-tipped hairs worn off in the Cerro San Felipe specimen, but probably very abundant and conspicuous in winter pelage); fore legs and feet dull fulvous, with very little black over wrists; hind legs and feet deep fulvous on outer side, the legs abruptly whitish on inner side and feet much paler on upper surface; under surface of tail fulvous, whitish basally; hairs of terminal third black-tipped.

Cranial and dental characters.—The skull of the adult male from Cerro San Felipe agrees with that of the type specimen of *Canis peninsulæ* in size and general cranial characters, but has the base of the rostrum very much thicker and more swollen, a broader and shorter palate (remarkably broad posteriorly), broader interpterygoid fossa, and much shorter mandible, which is strongly bellied under the carnassial and molars. The teeth are larger and heavier, particularly those of the lower

* The present description is based on a specimen (♂ adult) from the Cerro San Felipe, Oaxaca, Mexico, in summer pelage.

jaw. The upper carnassial is much more swollen and broadly rounded anteriorly, with a relatively insignificant inner cusp (*protocene*). The first upper molar is very large and broad and is broadly rounded on the inner side, without the posterior emargination of *C. peninsulæ*. The last upper molar is subquadrate and in contact with the first for nearly half the length of the anterior face. The lower premolars and carnassial are much larger, heavier, and more crowded than in *peninsulæ*, but the posterior molar is minute on one side and absent on the other (without trace of alveolus). A very young skull from the volcano of Toluca, which has not shed the milk teeth, has enormous audital bullæ; but very young skulls of wolves always have larger bullæ than adults.

Remarks.—Hamilton Smith's original description of *cagottis* is as follows: "The Caygotte of the Mexican Spaniards, and most probably the Coyotl of the native Indians, is a second species, but slightly noticed by travelers. Mr. William Bullock observed it near Rio Frio, in the Mexican Territory, and was informed by muleteers then with him that it was the Caygotte, a very fierce kind of wolf. The individuals he saw were in size equal to a hound, of a brownish rusty gray, with buff-colored limbs, and rather a scanty brush." While there is nothing distinctive about this description, it may be assumed, on geographic grounds, to apply to the animal from the Cerro San Felipe. For the same reason one would expect Lichtenstein's *C. nigrirostris* to belong here also; but Lichtenstein states that his animal has a black muzzle and short pointed ears, characters not possessed by any Coyote known to me. Lichtenstein's specimen was collected by Deppe at Real de Arriba, in the State of Mexico. If its skull is still in the Berlin Museum, its relations to the Cerro San Felipe skull may be easily ascertained. If not a freak it may be the large wolf of southern Mexico.

Measurements—Adult ♂ from Cerro San Felipe, Oaxaca: total length, 1132; tail vertebræ, 304; hind foot, 195.

Cranial measurements.—Adult ♂ from Cerro San Felipe: basal length, 164; basilar length of Hensel, 160; zygomatic breadth, 98; palatal length, 84; mastoid breadth, 59; length of crown of upper carnassial tooth, 21.

Canis peninsulæ sp. nov.

Type locality.—Santa Anita, Cape St. Lucas, Lower California. Type No. 74245, ♂ adult, U. S. National Museum, Department of Agriculture collection. Collected May 15, 1895, by J. E. McLellan.

General characters.—Similar to *C. ochropus* in size, large ears, and rich coloration, but colors darker and redder, underside of tail blacker; belly marked with black-tipped hairs; rostrum much broader.

Color.—Muzzle cinnamon rufous, the cheeks abundantly mixed with black hairs, almost forming a black patch under eyes; top of head grizzled grayish fulvous, mixed with black hairs between and above eyes; ears rich fulvous; upper parts buffy-ochraceous profusely mixed with black (under fur pale fulvous); underparts strongly washed with buffy-ochraceous or even pale fulvous, with numerous black-tipped hairs be-

tween fore legs and along middle of belly; long hairs of throat forming a strongly marked collar, tinged with buffy and conspicuously mixed with black-tipped hairs; fore and hind legs and feet fulvous; underside of tail fulvous, whitish basally; distal half with long hairs conspicuously tipped with black, forming a black veil over the fulvous.

Cranial and dental characters.—The skull which *Canis peninsulæ* resembles most closely is an adult male from the Cerro San Felipe, State of Oaxaca, Mexico, assumed to belong to the species named *cagottis* by Hamilton Smith. The skull of the type specimen of *peninsulæ* agrees with the Cerro San Felipe skull essentially in size and general characters, but the rostrum is not so short and broad (in the Cerro San Felipe skull it is remarkably broad posteriorly), and the lateral teeth, though large, are uniformly smaller and less swollen. The difference is most marked in the lower jaw. Compared with *C. frustror* from Texas, the skull of *peninsulæ* is shorter, the frontal shield lessel evated posteriorly, and the lateral teeth larger. Compared with its neighbor from the interior of California, *C. ochropus*, the rostrum is very much broader, the whole skull heavier and more massive, the horizontal ramus of the mandible deeper and more 'bellied,' and the lateral teeth larger and thicker.

Cranial measurements.—Type skull, ♂ adult: basal length, 169; basilar length of Hensel, 167; zygomatic breadth, 99; palatal length, 90; mastoid breadth, 57; length of crown of upper carnassial tooth, 20.5.

Canis microdon sp. nov.

Type locality.—Mier, on Rio Grande River, State of Tamaulipas, Mexico. No. $\frac{27555}{39654}$, ♂ adult, U. S. National Museum, Department of Agriculture collection. Collected April 28, 1891, by William Lloyd. Original No. 478.

Characters.—Size small; coloration rather dark; upper surface of hind foot whitish; belly sprinkled with black-tipped hairs; carnassial and molar teeth very small.

Color.—Muzzle pure cinnamon rufous; top of head grizzled grayish and ochraceous; ears fulvous; rest of upper parts buffy-ochraceous, profusely mixed with black hairs (under fur buffy or buffy-ochraceous); under parts whitish between fore legs and between thighs; middle of belly buffy, with black-tipped hairs extending all the way across and also reaching forward along median line to long hairs of throat, which latter are strongly marked with black-tipped hairs; fore legs and feet fulvous, becoming whitish on inner side of leg; upper side of forearm strongly mixed with black; hind legs and feet pale fulvous on outer side, changing to white on inner side of leg and upper surface of foot; under side of tail pale buffy fulvous, whitish at base, and with hairs of distal half broadly tipped with black.

Cranial and dental characters.—Skull short and broad; muzzle and palate exceedingly short and broad; teeth small, particularly the carnassial and first upper molar.

Remarks.—*Canis microdon* does not require close comparison with any known wolf. From its nearest relative, *C. mearnsi*, it differs in shorter

rostrum, smaller upper carnassial, and more emarginate first upper molar. Externally it differs from *mearnsi* conspicuously, the upper parts being darker and the fulvous tints deeper, duller, and less extensive. In *mearnsi* the whole of the legs and feet are bright orange-fulvous. In *microdon* the white of the under parts reaches down on the inner side of the legs all the way to the wrists and ankles, and the upper surface of the hind feet is white.

Canis microdon is distantly related to *C. vigilis*, of the southwest coast of Mexico, but it differs from *vigilis* in numerous and important characters. The palate is shorter and broader, and the carnassial and molar teeth of the male are about the size of those of the female *vigilis*. The external differences are even more marked. The sides of the face lack the conspicuous black hairs of *vigilis;* the under fur of the back is buffy or pale buffy-ochraceous instead of fulvous; the belly is white and buffy, abundantly mixed with black-tipped hairs instead of everywhere saturated with fulvous; the fulvous of the fore and hind legs is pale and less extensive; the black of the forearm less extensive; the color of the hind legs and feet entirely different: the outer side only of the hind leg is fulvous, the inner side being white and the upper surface of the hind foot white or whitish. In *vigilis* the hind legs and feet are deep fulvous all round. The hairs of the distal half of the tail are broadly tipped with black, while in *vigilis* they are fulvous throughout.

Measurements.—Type specimen, ♂ adult: total length, 1070; tail vertebræ, 320; hind foot, 186; weight, 28 pounds.

Cranial measurements.—Basal length, 161; basilar length of Hensel, 158; zygomatic breadth, 93.5; palatal length, 84; mastoid breadth, 57; length of crown of upper carnassial tooth, 16.5.

Canis mearnsi* sp. nov.

Type locality.—Quitobaquita, Pima County, Arizona. No. 59899, ♂ young adult, U. S. National Museum. Collected February 5, 1894, by Dr. Edgar A. Mearns. Original No. 2925.

Characters.—Size small; ears medium; coloration rich and bright, the fulvous tints exceedingly bright and covering the whole of the fore and hind legs and feet. Skull and teeth small.

Color.—Muzzle cinnamon rufous; space between eyes grizzled grayish and fulvous; top of head, nape, and ears rather light fulvous; rest of upper parts buffy-ochraceous bountifully mixed with black-tipped hairs (under fur bright buffy-ochraceous); under parts in pectoral and inguinal regions whitish, middle part of belly suffused all the way across with buffy-ochraceous; throat buffy, the long hairs black-tipped; fore and hind legs and feet bright orange-fulvous all round; upper side of fore

* Named in honor of Dr. Edgar A. Mearns, U. S. A., whose name will always be associated with the mammals of the Mexican boundary, and through whose courtesy I am indebted for the opportunity of describing the species.

legs moderately mixed with black; underside of tail pale fulvous, whitish at very base, hairs of distal half black-tipped; extreme end of tail black, usually with a few white hairs.

Cranial and dental characters.—Skull and teeth small and light as in *C. estor;* a little larger than in *C. microdon* from Mier, Tamaulipas.

Remarks.—*Canis mearnsi* is the handsomest of the Coyotes. It differs from *C. microdon* of the Lower Rio Grande region in slightly larger size and in the greater extent and much brighter tints of the fulvous parts. The fore and hind legs and feet are bright orange-fulvous all round; in *C. microdon* the fulvous is deeper and duller and the white of the inguinal region reaches down on the inner side of the hind leg to the ankle and covers the upper surface of the foot, and in the fore leg a white stripe reaches all the way down the posterior aspect of the leg to the wrist. Compared with *microdon*, the throat and middle part of the belly are more ochraceous and have fewer black-tipped hairs—the belly practically none. The skull and teeth of *mearnsi* are almost exactly like those of *estor*, but in coloration the two animals differ so widely as to require no comparison. Nevertheless, specimens collected by Dr. Mearns at Tinajas Altas, Arizona, are so much paler than typical *mearnsi* as to suggest intergradation.

Measurements.—Female adult from type locality: total length, 1100; tail vertebræ, 330; hind foot, 180 (measured in flesh by Dr. Mearns).

Cranial measurements.—Type specimen, ♂ young adult, not fully grown: basal length, 163; basilar length of Hensel, 160; zygomatic breadth, 83; palatal length, 88; mastoid breadth, 56.5; length of crown of upper carnassial tooth, 19.

Canis estor sp. nov.

Type locality.—Noland's ranch, San Juan River, Utah. No. 57141, ♀ adult, U. S. National Museum, Department of Agriculture collection. Collected November 20, 1893, by J. Alden Loring. Original No. 1379.

Characters.—Size small; coloration pale, but not quite so pale as in *pallidus;* carnassial and molar teeth small.

Color.—Muzzle exceedingly pale fulvous; top of head grizzled grayish and ochraceous buffy; ears and nape ochraceous buff; upper parts buffy, sparingly mixed with black hairs; under parts whitish; long hairs of throat conspicuously black-tipped; some black-tipped hairs along median line of breast; outer side of fore legs bright buff, pale on inner side and on fore feet; outer side of hind legs and feet buffy-ochraceous; inner side of hind leg and upper surface of hind foot white or whitish; under side of tail ochraceous, becoming white basally, the hairs of distal half conspicuously tipped with black; black tip short.

Cranial and dental characters.—Skull and teeth similar to those of *C. mearnsi*, but lateral teeth slightly larger. Compared with typical *ochropus*, the rostrum is somewhat more swollen in the females and conspicuously more in the males.

Remarks.—*Canis estor* bears the same relation to *C. mearnsi* that *pallidus* does to *latrans*. Both are pale desert forms, slightly smaller than the

species from which they have been derived. The collection of the Biological Survey contains specimens of *C. estor* from the Mohave Desert, Death Valley, the Panamint and Inyo ranges, Owens Valley, the San Juan in southeast Utah, Flowing Springs and Humboldt Wells, Nevada, and Playa Maria Bay, Lower California. The latter are not typical.

Measurements.—Type specimen, ♀ adult: total length, 1052; tail vertebræ, 300; hind foot, 179. Measurements of an adult male from Granite Well (base of Pilot Knob), Mohave Desert: tail vertebræ, 340; hind foot, 195.

Cranial measurements.—Type skull, ♀: basal length, 159; basilar length of Hensel, 155; zygomatic breadth, 89; mastoid breadth, 57; palatal length, 84; length of upper carnassial, 17.2

Canis ochropus Eschscholtz.

Canis ochropus Eschscholtz, Zoöl. Atlas, III, pp. 1–2, pl. 11, 1829.

Type locality.—'California.' (Specimens from Tracy, San Joaquin County, California, assumed to be typical.)

Characters.—Externally similar to *C. latrans* and *lestes*, but smaller, darker, and much more highly colored, with very much larger ears, and very much smaller skull and teeth.

Color.—Muzzle dull grizzled cinnamon rufous; top of head grizzled grayish fulvous; ears rich fulvous; nape sometimes fulvous; rest of upper parts buffy-ochraceous, profusely mixed with black hairs; under parts usually whitish, with a soiled yellowish wash across middle of belly, but sometimes suffused with pale fulvous; long hairs of throat strongly grizzled with black-tipped hairs, forming a conspicuous 'ruff,' the black-tipped hairs sometimes following the median line over the breast; fore and hind legs and feet dull fulvous all round, but paler on inner side and most intense on outer side of hind leg; upper side of forearm strongly marked with black; outer side of thighs strongly grizzled with black-tipped hairs; under side of tail pale fulvous, white basally, and tipped and edged with black; hairs of terminal third of under side of tail usually black tipped; extreme tip often white.

Cranial and dental characters.—The skull of *Canis ochropus* is disproportionally large for the size of the teeth, and the rostrum is long and slender. Compared with *C. estor*, probably its nearest relative, the skull is slightly larger, the rostrum decidedly longer and more slender, and the teeth very slightly larger. Compared with its neighbor, *C. lestes*, with which the skull agrees essentially in length, the entire cranium is narrower, particularly the rostrum, and the lateral teeth are so much smaller as to need no comparison.

Measurements.—Average of four females from Tracy, California: total length, 1110; tail vertebæ, 295; hind foot, 180.

Cranial measurements.—♂ adult, Tracy, California: basal length, 177; basilar length of Hensel, 174; zygomatic breadth, 94; palatal length, 98; mastoid breadth, 62; length of crown of upper carnassial tooth, 19. An

adult female from same place measures: basal length, 171; basilar length of Hensel, 167; zygomatic breadth, 94; palatal length, 90; mastoid breadth, 59; length of crown of upper carnassial tooth, 18.

Canis vigilis sp. nov.

Type locality.—Manzanillo, Colima, Mexico. Type No. $\frac{32627}{44550}$, ♀ young adult, U. S. National Museum, Department of Agriculture collection. Collected February 6, 1892, by E. W. Nelson. Original No. 1840.

Characters.—Similar to *C. peninsulæ*, but darker and more highly colored, with more black on forearm and no black on under side of tail except at tip; upper carnassial and first molar much smaller.

Color.—Muzzle dull cinnamon rufous; top of head grizzled buffy fulvous and black; ears fulvous, upper parts buffy-ochraceous, profusely mixed with black (under fur fulvous); under parts strongly suffused with pale fulvous; throat collar with black tips strongly marked; fore and hind legs fulvous, as in *ochropus*, but deeper, especially on fore feet; black on upper side of forearm more extensive; outer side of thigh and leg strongly intermixed with black-tipped hairs, which reach down to or below knee; under side of tail dull pale fulvous, whitish basally, and tipped with black (hairs of under side anterior to black tip *not* tipped with black).

Cranial and dental characters.—The skull of the type specimen of *Canis vigilis*, a young adult female, agrees in general characters with an adult female *peninsulæ* from Cape St. Lucas, but is somewhat larger, with slightly broader rostrum and longer and more slender mandible. The upper carnassial and molar teeth, however, are very much smaller and show that the two animals belong to different sections of the group. Compared with *Canis mearnsi*, its nearest neighbor on the north, *C. vigilis* has a larger skull and very much smaller teeth, particularly the upper carnassial and first molar. The first upper molar is decidedly smaller than in any known form except *C. microdon*, from which it differs in being deeply notched posteriorly.

Measurements.—Type specimen, ♀ young adult: total length, 1155; tail vertebræ, 335; hind foot, 190.

Cranial measurements.—Type specimen: basal length, 166; basilar length of Hensel, 163; zygomatic breadth, 87; palatal length, 85; mastoid breadth, 59; length of crown of upper carnassial tooth, 17.5.